Topic: Chain rule with power rule

Question: Use power rule and chain rule to find the derivative.

$$y = \left(5x^2 + 2x - 8\right)^5$$

Answer choices:

A $y' = \left(5x + 2\right)\left(5x^2 + 2x - 8\right)^4$

B $y' = \left(50x + 10\right)\left(5x^2 + 2x - 8\right)^5$

C $y' = \left(50x + 10\right)\left(5x^2 + 2x - 8\right)^4$

D $y' = \left(50x - 10\right)\left(5x^2 + 2x - 8\right)^4$

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Solution: C

Remember that, to use chain rule, you'll take the derivative of the outside function first, leaving the inside function completely untouched, and then multiply by the derivative of the inside function.

In this particular problem, you can think of the outside function as u^5, where $u = 5x^2 + 2x - 8$. To differentiate this outside function, you'll use power rule, and get $5u^4$. When you plug back in for u, you get $5\left(5x^2 + 2x - 8\right)^4$.

Now all you need to do is multiply by the derivative of the inside function, $5x^2 + 2x - 8$, which, by the power rule, is $10x + 2$. Therefore, the final answer is

$$y' = 5\left(5x^2 + 2x - 8\right)^4 (10x + 2)$$

$$y' = \left(50x + 10\right)\left(5x^2 + 2x - 8\right)^4$$

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Topic: Chain rule with power rule

Question: Use power rule and chain rule to find the derivative.

$$f(x) = \sin^3 x$$

Answer choices:

A $f'(x) = 3\sin^2 x \cos x$

B $f'(x) = 3\sin^2 x$

C $f'(x) = 3\cos^2 x$

D $f'(x) = \cos^3 x$

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Solution: A

First, note that $f(x) = \sin^3 x$ can be re-written as $f(x) = (\sin x)^3$. From this we can see that f is a composite function, where $\sin x$ is the "inside" function. If we make a substitution for the inside function, setting

$$u = \sin x$$

and

$$u' = \cos x$$

then we get

$$f(x) = u^3$$

Therefore, the derivative is

$$f'(x) = 3u^2 \cdot u'$$

$$f'(x) = 3(\sin x)^2 \cdot \cos x$$

$$f'(x) = 3 \sin^2 x \cos x$$

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Topic: Chain rule with power rule

Question: Use power rule and chain rule to find the derivative.

$$f(y) = \left(y^3 + 1\right)^{25}$$

Answer choices:

A $f'(y) = \left(3y^2\right)^{25}$

B $f'(y) = 25\left(y^3 + 1\right)^{24}$

C $f'(y) = 75y^2\left(y^3 + 1\right)^{24}$

D $f'(y) = 25\left(3y^2\right)^{24}$

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Solution: C

First, note that $f(y) = \left(y^3 + 1\right)^{25}$ is a composite function, where $y^3 + 1$ is the "inside" function. If we make a substitution for the inside function, setting

$$u = y^3 + 1$$

and

$$u' = 3y^2$$

then we get

$$f(y) = u^{25}$$

Therefore, the derivative is

$$f'(y) = 25u^{24} \cdot u'$$

$$f'(y) = 25\left(y^3 + 1\right)^{24} \cdot 3y^2$$

$$f'(y) = 75y^2\left(y^3 + 1\right)^{24}$$

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